

SUSTAINABLE SUPPLY CHAIN MANAGEMENT IN CONSTRUCTION FIRMS

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Environmental change is happening everywhere. Turbulent weather patterns - heat waves, rains, snowfalls, hurricanes and stormy rains are becoming extreme in every sense throughout the world. These climatic changes are today a concern of every individual and world leader alike. The burning of oil and other fossil fuels releases carbon dioxide, which rises, blankets the earth and traps heat causing severe changes in weather patterns. Not only do we have climate problems but we are also dealing with a resource depletion issue. The construction industry has a major impact on the environment because 50% of the material resources for construction are taken from nature. The huge consumption of resources by the construction industry has called for sustainable practices in construction. Sustainable supply chain provides economic, social and environmental requirements in material and service flows occurring between suppliers, manufacturers and customers. Sustainable development has taken the centre stage among different countries of the world. During the 1992 Earth Summit in Rio, the governments and other international organizations decided to take useful measures to protect the environment for long term social and economic development. This paper aims at investigating the compliance of the construction industry to environmental regulations. In this paper, the construction industry of Lagos state in Nigeria was used as a case study.

Keywords: construction industry, environmental regulation, sustainability, sustainability development.

INTRODUCTION

Sustainability is sometimes used interchangeably with green. Sustainable supply chain provides economic, social, and environmental requirements in material and service flows occurring between suppliers, manufacturers and customers (Buyukozkan et al., 2011). While green supply chain management is mainly involved with environmental thinking, sustainable supply chain management broadens its focus to three main pillars; economic, social, and environmental. Sustainable Development is the key concept as discussed in 1992 Earth Summit in Rio Brazil, the governments and other international organizations have decided to take useful measures to protect the environment for long term social economic development (Johannesburg summit, 2002).

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The concept of sustainability is not new, but has changed over the past fifty years. According to the international institute for sustainable development, the term first originated in 1962 with the gradual merging of the environmental movement and the post-World War II international development community, unlike the environmental movement a generation ago, sustainability today carries a strong connotations of win-win benefits, efficiency, high performance, long term thinking and getting it. Despite the current recession, leading corporations across all sectors of the industry will increasingly make supply chain sustainability an integral element of their strategy, from product development to manufacturing and the supply chain to marketing and communications (Van den Broek, 2010). Sustainability is a form of development that meets the needs of the present needs without compromising the ability of future generations in meeting their own needs. Sustainability design goes far beyond simply creating products that benefits consumer in terms of better air environment, cost savings and durability, rather effective sustainable design must illustrate a thorough understanding of a full systems approach of products in their environment and interaction, with other products, as well as the effect on many other factors. It should be viewed as a process and not just a goal, that allow a broader evaluation over time of the environmental, economical and societal impacts of buildings products. Viewing sustainability as a process is essential for green designs as specifiers are challenged to evaluate the full life cycle of products.

Whether firms can benefit from being “green” has become an important question in the business strategy literature as exemplified by the considerable empirical research analyzing the link between beyond-compliance environmental strategy and financial performance or competitive advantage (Damania, 2001; Dowell, Hart, and Yeung, 2000; King and Lenox, 2001; Konar and Cohen, 2001; Margolis and Walsh, 2003; McWilliams and Siegel, 2000; Orlitzky, 2008; Orlitzky, Schmidt, and Rynes, 2003.). Although, the empirical literature on the link between environmental strategies and competitive advantage, mostly rooted in economics, emphasizes external drivers such as regulation, we still have little understanding of the organizational mechanisms that link the adoption of environmental management practices or strategies to competitive advantage (Marcus, 2005). The term ‘sustainable construction’ is generally used to describe a process which starts well before construction (in the planning and design stages) and continues after the construction team have left the site (Hill and Bowen, 1997). In the light of construction, construction industry plays a vital role towards achieving national and international strategies for social and economic development. It contributes towards increasing the Gross Domestic Product (GDP), stimulating growth of other industries and creating job opportunities as well as providing the societies with facilities and infrastructure projects that meet their needs and fulfill their requirements but having a major impact on the environment because about 50% of the material resources for construction are taken from nature, 40% of energy consumption and 50% of total waste generated (Othman, 2010). The huge consumption of the resources by construction industry has called for sustainable construction in order to meet the present and future needs. Primary goal of sustainability is to reduce humanity’s environmental or ecological footprint on the planet. Sustainable development has given rise to green buildings. Most green building practices fall into seven basic categories: energy saving, land saving, storm water runoff-reducing, material conservation and pollution reduction (ECONorthwest, 2001). A green building uses an average of 30% less energy than conventional building (Economist, 2004). Material waste generated during construction is reduced or recycled. Energy efficiency is improved, perhaps by relying on the use of natural

light and ventilation or solar power. Less water is used, or rainwater harvesting system is installed to ensure a wiser use. Measures taken to make buildings and construction more sustainable rely increasingly on life cycle approaches.(cited by Nwokoro and Onukwube, 2011)

SUSTAINABLE DEVELOPEMENT DEFINED

Sustainable development refers to a mode of development in which resource use aims to meet human needs while preserving the environment so that the needs can be met not only in the present, but also for generations to come. The term sustainable development was used by the Brundtland Commision which coined what has become the most often –quoted definition of sustainable development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland, 1987). It ties together concern for the carrying capacity of natural systems with the social challenges faced by humanity. As early as the 1970s, sustainability was employed to describe an economy in equilibrium with basic ecological support systems. Ecologists have pointed to the limit to growth, and presented the alternative of a steady state economy.

Sustainable construction is the adoption of materials and products that will require less use of natural resources and increase the reusability of such materials and products for the same or similar purpose, thereby reducing waste as well. Sustainable construction also enhances the resilience of the industry as such; materials are readily available in the world market (Sustainable Construction, 2007).

Macquarie dictionary defines Compliance as an act of conforming, acquiescing and yielding or base subservience. Environmental compliance may be defined by the various stakeholders in the mining industry, companies, governments and communities are considered in the light of their possible objectives in requiring environmental compliance. Example of potentially conflicting environmental requirements in waste management are considered, particularly operational requirements such as minimal dust generation versus completion environmental compliance requirements of establishing a self sustaining ecosystem or geomorphologically stable landform. Mechanisms are available to establish standards to determining if environmental compliance has been attained or not. In Administrative and Society report, it was concluded that the environmental compliance means conforming to the environment rather than simply acquiescing or yielding to manmade rules (Parker, 2000).

Standardization (ISO) is becoming more popular among local governments, international commissions, armed forces, and members of the public sector (Moutchnik, 2006). It was established in 1996, the ISO 14001 standard specifies the requirements for an environmental management system. Companies or individual facilities that are certified by ISO 14001 potentially benefit from improved and steady overall performance and regulatory compliance, efficiency in achieving their environmental goals, and strengthened relationship with their stakeholders and customers, not to mention the expanded universe of potential customers not otherwise accessible. This voluntary standard is applicable to any company interested in implementing or improving an environmental management system, demonstrating conformance, and seeking certification of its environmental management system. Many firms believe that using an external third-party organization helps to ensure that a company will comply with the legal and policy requirements associated with environmental management (ISO, 2004).

Regulations in the building industry are becoming increasingly complex and involve more than one technical area, covering products, components, project implementations and also play an important role in ensuring the quality of a building, and to minimize its environmental impact (Bouzidi et al., 2012).

STUDY AREA

Lagos State, Nigeria was created on May 27, 1967 by virtue of State (Provisions) Decree No. 14 of 1967, which restructured Nigeria's Federation into 12 states. Prior to this, Lagos Municipality had been administered by the Federal Government through the Federal Ministry of Lagos Affairs as the regional authority, while the Lagos City Council (LCC) governed the City of Lagos. Equally, the metropolitan areas (Colony Province) of Ikeja, Agege, Mushin, Ikorodu, Epe and Badagry were administered by the Western Region. The State took off as an administrative entity on April 11, 1968 with Lagos Island serving the dual role of being the State and Federal Capital of Nigeria. However, with the creation of the Federal Capital Territory of Abuja in 1976, Lagos Island ceased to be the capital of the State which was then moved to Ikeja. Equally, with the formal relocation of the seat of the Federal Government to Abuja on 12 December 1991, Lagos Island ceased to be Nigeria's political capital but remains the center of commerce for the country (www.city-data.com).

RESEARCH METHODOLOGY

In this section, we present the method of how we obtained the statistics about Nigerian firms. This paper makes use of detailed questionnaire to verify environmental compliance by the construction companies in Lagos state, Nigeria. Section A comprised of the demographical

characteristics of the respondents while section B contained the specific questions addressing the focus of this study. It was administered to site managers/project managers/environmental managers of both public and private construction companies in the state. A total of 35 valid responses were received from the 100 questionnaires successfully e-mailed and sent out, representing a response rate of 35%. Whilst this response rate is perhaps a little disappointing, it is not surprising as the research focus; Green Supply Chain Management is new to them, given the commercially sensitive nature of questions relating to an organization's competitive positioning, and the nature of the research instrument. However, the fact that our sample comprised responses from organizations representing a wide variety of sizes and sectors provides much reassurance that our sample is likely to represent the Environmental Compliance in Lagos State.

Use of questionnaire was adopted for this data collection due to the nature of the respondents involved. They are generally very busy people and it is hard to keep appointment with them for an interview.

RESEARCH QUESTIONS

The research questions used in this study are stated below:

Is Green Supply Chain Mangement (GSCM) new in Nigeria?

Does GSCM relevant to Nigerian construction firms?

Is GSCM environmental compliance?

How sustainable is GSCM?

DATA ANALYSIS

This sub-section is concerned with how the data collected will be transformed in order to satisfy the requirements needed to answer the research questions formulated in the study. Firstly, the data was coded and analyzed using the Statistical Package Software for Social Sciences (SPSS) ; both descriptive and inferential statistics was used for the analyses. Frequency, percentages and cross tabulation of variables was used for the descriptive statistics (Cody, 2011). This method of analysis has been employed by other construction management studies.

The demographic information of the respondents are presented in Table 1.

Table 1: Demographic Information of the Respondents

Variable Name	Variable Value	Frequency	Percent	Valid Percent	Cumulative Percent
Type of Project	Civil Engineering	21	60.0	67.7	67.7
	Building Construction	10	28.6	32.3	100.0
	Total	31	88.6	100.0	
	Missing	4	11.4		
	Total	35	100.0		
Years of Experience	2-4	6	17.1	19.4	19.4
	5-8	13	37.2	41.9	61.3
	9-11	6	17.1	19.4	80.7
	12-15	4	11.4	12.9	93.6
	16-18	1	2.9	3.2	96.8
	19-21	0	0		96.8
	22-24	1	2.9	3.2	100.0
	Total	31	88.6	100.0	
	Missing	4	11.4		
	Total	35	100.0		
Gender	Valid Male	21	60.0	60.0	60.0
	Female	14	40.0	40.0	100.0
	Total	35			
Academic Qualification	Valid HND/BSC	27	77.1	77.1	77.1
	Msc	8	22.9	100.0	100.0
Status in the Organization	Valid Managing Partner/Director	2	5.7	5.7	5.7
	Construction/Project Manager	23	65.7	82.1	87.3
	Environmental/Supply Manager	3	8.6	10.7	100.0
	Total	28	80.0	100.0	
	Missing	7	20.0		
	Total	35	100.0		

Table 1 illustrates the demographic information about the respondents of this study. From the Table, it can be seen that there are valid 35 respondents, though in some variables, there are some missing which means some of the respondents did not answer some of the questions.

The results show that the respondents are more into civil engineering compared to building construction.

For their years of work experience, the mean was estimated at 8 years, which represents the working experience of about 41.95% of the valid respondents. Hence, with this average working experience, respondents are deemed experienced enough to supply reliable data for this study.

The Table also shows that there are more male respondents compared to the females, thereby depicts the societal norm of more male engineers than the female engineers.

The Table further shows that practicing engineers in Lagos State Construction firms are more professionally inclined than being academia, however the majority of the respondents posses HND/B. SC (77.1%) which shows that the respondents have a foundational training in the field.

Lastly, the Table also revealed that the majority of the respondents are construction/project managers, while there are few environmental/supply managers which explained and butress that Supply chain management is new in Lagos state construction firms.

The data obtained from section B of the research questionnaires which is Research focused is presented in Tables 2 to 6

Table 2: Implementation and maintaining environmental standard by Suppliers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	26	74.3	83.9	83.9
	No	5	14.3	16.1	100.0
	Total	31	88.6	100.0	
Missing	System	4	11.4		
Total		35	100.0		

The result shows that construction firms in Lagos state require the supplier to implement and maintain environmental standards. This can be attributed to the fact that the firms knows the the importance of environmental friendly materials in construction works.

Table 3:Construction firms face environmental pressures

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	8	22.9	27.6	27.6
	No	21	60.0	72.4	100.0
	Total	29	82.9	100.0	
Missing	System	6	17.1		
Total		35	100.0		

Only 8 respondents agreed that their company is facing environmental pressures while 26 stated that their company is not, this may be due to the fact that others did not really understand what environmental pressure is.

The results show that acquisition of right of way, flooding, office location, pollution and rain are environmental pressures facing Lagos state construction firms as indicated by the respondents, however from the literature(www.oecd.org/env), it could

be affirmed that acquisition of right of way and office location are not environmental pressures. Flooding, rain and pollution are some of the environmental pressures faced by the construction firms in Nigeria. Flooding is the most rampant environmental pressure in Lagos state as shown in the result.

Table 4: Environmental pressures

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Acquisition of right of way	1	12.5	16.7	16.7
	Complaint of flooding all our Lagos State	1	12.5	16.7	33.3
	Flooding	1	12.5	16.7	50.0
	Office location	1	12.5	16.7	66.7
	Pollution	1	12.5	16.7	83.3
	Rain	1	12.5	16.7	100.0
	Total	6	75.0	100.0	
Missing		2	25.0		
Total		8	100.0		

Table 5: Pressures creators

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	The government	2	25.0	28.6	28.6
	Contractors	1	12.5	14.3	42.9
	Other stakeholders	4	50.0	57.1	100.0
	Total	7	87.5	100.0	
Missing	System	1	12.5		
Total		8	100.0		

Out of the 7 respondents that stated the entity responsible for the pressures, 4 respondents accrued it to other stakeholders. The result pointed out that other stakeholders who could be external stake holders such as environmental regulations could be responsible for the pressure facing Lagos State Construction firms.

Out of the 35 respondents, 33 responded to this question and it was found that they sometimes engaged in the GSCM practice. The table shows that construction firms in Lagos State expect the suppliers to be environmentally compliance and certified to a recognised body like ISO 141, but they are not investing in ensuring the compliance. The result answers the research question that environmental regulations have a significant impact on adopting Green Supply Chain management practices in Lagos Nigeria.

CONCLUSION

This paper adopted GSCM practice to check the level of compliance to regulations by the Lagos State construction firms. Results showed that GSCM is still new in the industry as seen in the low response. Though literature and results confirmed that

GSCM regulations exist in Lagos State, the construction firms are lacking behind as they expects the suppliers to conform to it while they are not investing in it.

Table 6: GSCM practices for environmental compliance

	Never	Rarely	Sometimes	Often	Always	Total
Does your company purchase construction materials with environmentally friendly attributes, such as recycled materials, and those with non-toxic ingredients?	Count 5	1	6	11	9	32
%	15.6%	3.1%	18.8%	34.4%	28.1%	100.0%
Do suppliers disclose information about their environmental practices and pollution discharges?	Count 7	3	14	4	3	31
%	22.6%	9.7%	45.2%	12.9%	9.7%	100.0%
Do you audit suppliers to evaluate their environmental performance?	Count 4	7	9	11	2	33
%	12.1%	21.2%	27.3%	33.3%	6.1%	100.0%
Do you require suppliers to implement and maintain environmental management?	Count 1	2	12	8	9	32
%	3.1%	6.3%	37.5%	25.0%	28.1%	100.0%
Do you require suppliers to obtain certification of their environmental management systems to a recognized body?	Count 3	3	10	9	8	33
%	9.1%	9.1%	30.3%	27.3%	24.2%	100.0%
Do you work with suppliers to help them reduce environmental impacts through changes in product design and materials use?	Count 2	5	13	7	6	33
%	6.1%	15.2%	39.4%	21.2%	18.2%	100.0%
Does your firm organize training programmes for suppliers to increase their knowledge of environmental implications of their product?	Count 8	12	7	4	2	33
%	24.2%	36.4%	21.2%	12.1%	6.1%	100.0%
Do you inform suppliers of technological developments relating to their operations?	Count 4	5	19	3	2	33
%	12.1%	15.2%	57.6%	9.1%	6.1%	100.0%

In conclusion, there is need for awareness of Green Supply Chain Management in Lagos, Nigeria which is the addition of environmental thinkings into supply chain management which will bring about sustainability in construction and thereby give a competitive edge.

RECOMMENDATIONS

This study provided an insight where basic development can be done. The results showed that the Lagos State construction firms are not aware of adopting such strategic practices, but they might be in the early learning stage of such organization

environmental practices and still there is a gap between awareness and adoption of such strategic practices. Based on the findings of this study, which shows that some respondents cannot identify pressures on adopting Green Supply Chain Management practices in the State construction firms, also they are not organizing training for the suppliers, there is a need for them to become better educated in developing co-operative relationship with their suppliers, customers, and the community of the stakeholders for the common environmental objectives. This study is one of the efforts to determine the drivers of GSCM adoption among Lagos State construction firms and our investigations are exploratory and future studies can also include investigation of longitudinal relationship identified in this research. In this research study, limited number of companies was included, as such; another survey with a larger set of companies is needed. In addition, there is a need to investigate further the pressures which may exist and also the effects of GSCM practices on organization economic, environmental and operational performance as well as the relationship between each driver on the organizational performance. Furthermore, the various relationships, such as mediating and moderating the relationship that may exist among the different factors should be investigated.

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REFERENCES

- Bouzidi K. R. , Fies B.,Faron-Zucker C., Zarli A., and Le Thanh N. (2012), Semantic Web Approach to Ease Regulation Compliance Checking in Construction Industry, ISSN 1999-5903 www.mdpi.com/journal/futureinternet
- Buyukozkan G., Berkol C., Ersoy M.S.(2011), “Supplier Selection with Sustainability Perspective using an Integrated Fuzzy MCDM Approach”, 9th International Logistics and Supply Chain Congress-LM SCM 2011, İzmir, 27-29 October 2011.
- Brundtland G. H. (1987), United Nations Report of the World Commission on Environment and Development:Our Common Future.Transmitted to the General Assembly as an Annex to document A/42/427 – Development and International Cooperation: Environment.
- Cody, Ron, SAS Statistics by Example. Copy right @ 2011, SAS Inc., Cary, NC, USA. ISBN 978-1-61290-012-4.
- ECONorthwest (2001). Green Building: Saving Money and the Environment; Opportunities for Louisiana. Eugene, Oregon.
- Van den Broek F., (2010), Green Supply Chain Management, Marketing Tool or Revolution?
- Hill, R.C and Bowen, P.A. (1997). Sustainable Construction, Principles and Framework for Attainment, *Construction Management and Economics*, 15, 223-239.
- ISO (International Organization for Standardization). 2004. International Standard ISO 14001: Environmental Management Systems – Requirements with Guidance for Use, second ed. Reference No. ISO14001:2004(E). ISO, Geneva.
- Johannesburg summit (2002), World summit on Sustainable development, www.johannesburgsummit.org.n.d.web. 2002.
- Marcus, A. (2005). Research in strategic environmental management. In S. Sharma and J. A. Aragon-Correa (Eds.), *Corporate environmental strategy and competitive advantage*. (page. 27-49). Cheltenham, UK: Edward Elgar.

- Margolis, J.D., and Walsh, J.P. (2003). Misery loves companies: Rethinking social initiatives by business. *Administrative Science Quarterly*, 48, 268 -305.
- McWilliams, A., and Siegel, D. (2000). Corporate social responsibility and financial performance: Correlation or misspecification? *Strategic Management Journal*, 21, 603-609.
- Moutchnik, A., 2006. ISO 14001 on Public Sector Agenda at all Levels around the World. ISO.
- Nwokoro I., and Onukwube H., (2011), Sustainable or Green Construction in Lagos, Nigeria: Principles, Attributes and Framework, *Journal of Sustainable Development*, Volume. 4, No. 4; August 2011. www.Ccsnet.org/jsd.
- Othman, A.A.E. (2010) Incorporating innovation and sustainability for achieving competitive advantage in construction. In: Wallis., Bilan, L., Smith, M. and Kazi, A.S. (eds) *industrialised, integrated, intelligent sustainable construction I3CON Handbook 2*, PAGE.13 -42.
- Orlitzky, M. (2008). Corporate social performance and financial performance: A research synthesis. In A. Crane, A. McWilliams, D.Matten, J.Moon, and D.Siegel (Eds.), *The Oxford handbook of CSR* (page.113-134). Oxford, UK: Oxford University Press.
- Orlitzky, M., Schmidt, F.L., and Rynes, S.L. (2003). Corporate social and financial performance: A meta-analysis. *Organization Studies*, 24, 403-441.
- Parker, C. (2000). Reinventing regulation within the corporation: Compliance-oriented regulatory innovation. *Administration and Society* 32(5): 529-565.
- Sustainable Construction (2007), *Materials for Building*.
- www.city-data.com
- www.oecd.org/env